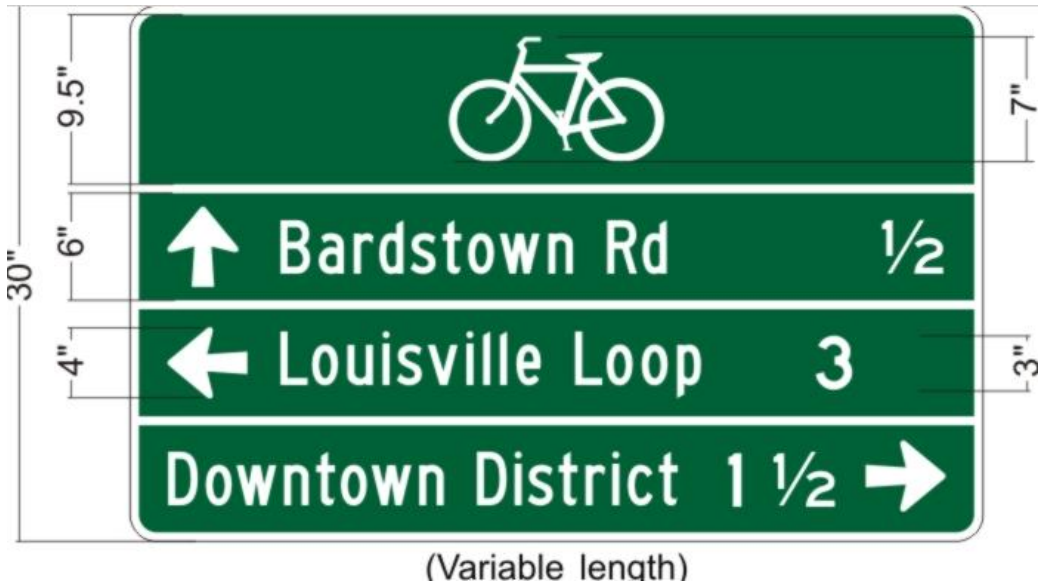
FEDERAL HIGHWAY ADMINISTRATION APPLICATION



Bicycle Wayfinding signed Network

Submitted by
Louisville Metro Government

December, 2011

BACKGROUND

Louisville is a great place to ride a bike. There are around 5,000 people in Louisville's workforce who use a bicycle as a mode to commute to work. Thousands of others bicycle to school, to access transit, visit friends and to access other destinations. The Louisville Bike Club has a membership well over 1200 members who have logged collectively over 605,000 miles of bicycling in 2010! Louisville is the home for Bicycling for Louisville which is the regions only bicycle advocacy organization with a paid staff, dedicating the time, energy and resources needed to make Louisville and the surrounding region a safe and fun place to be a bicyclist.

Events like Louisville's Hike & Bike and Bike to Work Day brings us back to an age where bicycles were the primary means of transportation in Louisville. Every day you can see more and more people - though on notably more high-tech bicycles - riding to work, school, and the store in Louisville. These new pioneers give us hope for a future in which Louisville will, in the words of Mayor Greg Fischer, "To transform our city into a truly bicycle friendly community."

More recently, Louisville hosted its second regional Bicycle Summit in February 2009. Several hundred people attended, including elected officials, community leaders, cyclists, professionals and other citizens.

The goal of the Bicycle Summit was to develop strategies to guide the Louisville region in creating safe and sustainable bicycling facilities and programs to improve community health, air quality and tourism. As a result of discussions in breakout sessions covering the areas of on-road facilities, trails, programs (safety, advocacy, enforcement) and policy, the summit created a vision for a bicycle-friendly Louisville and established a set of goals and a timeline for achieving them.

Currently there is over 36 miles of bicycle lanes, 24 miles of multi-use trails, and over 110 miles of other treatment forms. Louisville Metro has over 170 miles of bicycle facilities. Like all bicycle friendly cities, Louisville's main focus is safety and connectivity.

INTRODUCTION

Bikeway signage is a cost-effective treatment to improve Louisville's bicycling environment. This plan is intended to provide Louisville with a comprehensive guide for the development and implementation of a bicycle Wayfinding signed network that will enhance existing and proposed cycling infrastructure. Part 1 of this Plan provides information regarding the proposed changed sign design to the current MUTCD bicycle Wayfinding sign while maintaining the general guidance on signage design – including dimensions, color, marking design, and layout of individual signs – that is consistent with regional and national standards and describes signing placement standards. Part 2 of this Plan provides detailed suggestions for sign locations and signed destinations based on a two mile node spacing network.

PART ONE

BIKEWAY SYSTEM UPDATE

According to National Association of City Transportation Officials (NACTO) a bicycle wayfinding system consists of comprehensive signing to guide bicyclists to their destinations along preferred bicycle routes. Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

Part of this planning process included a review of the existing and proposed bikeway system. This review was undertaken to ensure that bicycle Wayfinding signage provides the best complement possible to the existing and future bikeway system. The proposed changes do not make major modifications to the system, but rather provide clarification to proposed routes or rerouting of proposed future facilities through an additional of a larger bicycle symbol on top of the sign while removing the smaller bicycle symbols along each of the panels.

These changes were proposed by Bike Louisville and refined through public comment during development of this Plan. Figure 1.1 shows current proposed facility additions including the proposed bicycle Wayfinding signage plan labeled low cost projects and denoted by a red line. 'Planned' bikeways are characterized as future facilities by the 2010 Bike Master Plan. If accepted it is anticipated that Bike Louisville will present amendments to the 2010 Bike Master Plan for the Bike Louisville Task Force adoption in late 2011.

NEED FOR ENHANCED BICYCLE WAYFINDING SIGNAGE

Louisville currently has a number of recreational bicyclists, but according to the League of American Bicyclists Louisville needs to increase the number of people who bicycle as an alternative means of transportation. Currently, the 2009 Behavioral Risk Factor Surveillance Survey reports Louisville's population is 34% obese, 30% overweight and 53% reported they did meet the recommended amount of monthly physical activity. According to the 2000 Census data, only 4.1% and .8% of Louisville's residents used walking and bicycling as their mode of transportation to work, respectively.

According to the National Household Travel Survey, (2001) in the US, 41 percent of all trips made in 2001 were less than 2 miles and 28 percent were less than 1 mile. However, Americans used automobiles for about 74 percent of trips less than 2 miles and 66 percent of trips less than 1 mile. Even though most trips are less then 2 miles or 10-20 minutes, cycling still only makes up less than 1 percent of these trips.

By updating the current bicycle Wayfinding signage network to be based on a two mile node network will help provide a bicycle facility that will promote bicycling as an alternative means of transportation. In addition to an updated bicycle Wayfinding signage network it is being proposed these bicycle Wayfinding signs include a larger bicycle symbol on top of the sign while removing the smaller bicycle symbols along each of the panels. While including the currently accepted MUTCD elements which include: distance, direction and location.

Signage can serve both Wayfinding and safety purposes, including:

- Familiarizes users with the bicycle network.
- Identifies the best routes to destinations.
- Overcomes a "barrier to entry" for infrequent bicyclists.
- Signage that includes mileage to destinations may help minimize the tendency to overestimate the distance it takes to travel by bicycle.
- Visually indicates to motorists that they are driving along a bicycle route and should use caution.
- Passively markets the bicycle network by providing unique and consistent imagery throughout the jurisdiction.

Placing signs throughout Louisville indicating to bicyclists their direction of travel, the location of destinations, and the riding distance to those destinations will make the bicycle system more accessible to all users. Wayfinding signs also provide visual cues to motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Choosing the right number of signs is important, since having too many road signs can clutter the right-of-way. It is recommended that Wayfinding signs be posted at a level most visible to bicyclists and pedestrians.

Figure 1.1 Wayfinding Network
See this map online:
http://services.louisvilleky.gov/media/bikelouisville/masterplan/Future_Bike_Facility_lowcost.pdf

BIKEWAY WAYFINDING SIGNAGE DESIGN GUIDANCE

Uniformity, legibility, and adherence to existing standards are among the elements to consider when determining the appropriate Wayfinding sign design for Louisville. National, state, and local standards, along with local input, should guide the development of signage design.
National guidance on Wayfinding signage is found in the ***Manual on Uniform Traffic Control Devices*** (MUTCD) and the American Association of State Highway and Transportation Officials (AASHTO) ***Guide for the Development of Bicycle Facilities***. Locally, Louisville has developed and employed a bicycle Wayfinding system for many years.

MUTCD

The standards contained in this document are based on the updates to the 2009 MUTCD; it is anticipated that these updates will be adopted in the future. The MUTCD uses highly specific language to classify design guidelines. The following terms are defined by the MUTCD:

> **Standard:** A statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device.
>
> **Option:** A statement of practice that is a permissive condition and carries no requirement or recommendation.
>
> **Guidance:** A statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate.

For example, the speed limit sign Standard states that a speed limit sign will be placed at points of change from one speed to another, while Guidance suggests that warning signs be posted prior to a speed change to alert motorists of the upcoming change. A section on Options covers factors that may be used in addition to engineering studies to determine optimal speed limits.
Bicycle guide signs are defined by the following Standards, Options, and Guidance found in MUTCD Section 9B.20 Bicycle Guide Signs.

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Bike Guide Signs

Design Guidelines

There are general guidelines to follow in the design of highway signs in order to conform to basic standards. Many of these guidelines are mentioned in various sections of the Manual on Uniform Traffic Control Devices (MUTCD), while others are derived from accepted practice in sign design and layout. Highway signs with standardized designs conforming to the general guidelines (like most regulatory warning, emergency management, school, railroad highway grade crossing, and bicycle signs) are contained in the MUTCD and are shown with different standard sizes depending on the type of highway or facility where the sign is intended to be used. Although some guide signs also have been standardized and are included in the MUTCD, most guide signs need to be designed

separately because of the variability in message or legend. For most guide signs, there can be no rigid standardized sizes. An accepted "rule-of-thumb" to follow for legibility for signs other than interstate is the have one inch (25mm) of letter height for every 40 feet (12 M) of desired legibility.

Option:
Bike Route Guide (D11-1) signs (see Figure 1.2, MUTCD Figure 9B-4) may be provided along designated bicycle routes to inform bicyclists of bicycle route direction changes and to confirm route direction, distance, and destination. If used, Bike Route Guide signs may be repeated at regular intervals so that bicyclists entering from side streets will have an opportunity to know that they are on a bicycle route. Similar guide signing may be used for shared roadways with intermediate signs placed for bicyclist guidance. Alternative Bike Route Guide (D11-1c) signs may be used to provide information on route direction, destination, and/or route name in place of the "BIKE ROUTE" wording on the D11-1 sign (see Figures 9B-4 and 9B-6). Destination (D1-1, D1-1a) signs, Street Name (D3) signs, or Bicycle Destination (D1-1b, D1-1c, D1-2b, D1-2c, D1-3b, D1-3c) signs (see Figure 9B-4) may be installed to provide direction, destination, and distance information as needed for bicycle travel. If several destinations are to be shown at a single location, they may be placed on a single panel with an arrow (and the distance, if desired) for each name. Destination will be in the order of straight ahead destination on top followed by destinations to the left and then destinations to the right.

Guidance:
Adequate separation should be made between any destination or group of destinations in one direction and those in other directions by suitable design of the arrow, spacing of lines of legend, heavy lines entirely across the panel, or separate panels.

Directional Arrows

Standard:
An arrow pointing to the right, if used, shall be at the extreme right-hand side of the sign. An arrow pointing left or up, if used, shall be at the extreme left-hand side of the sign. The distance numerals, if used, shall be placed to the right of the destination names. On Bicycle Destination signs, a bicycle symbol shall be placed next to each destination or group of destinations. If an arrow is at the extreme left, the bicycle symbol shall be placed to the right of the respective arrow.

Guidance:
Unless a sloping arrow will convey a clearer indication of the direction to be followed, the directional arrows should be horizontal or vertical. The bicycle symbol should be to the left of the destination legend. If several individual name panels are assembled into a group, all panels in the assembly should have the same horizontal width.

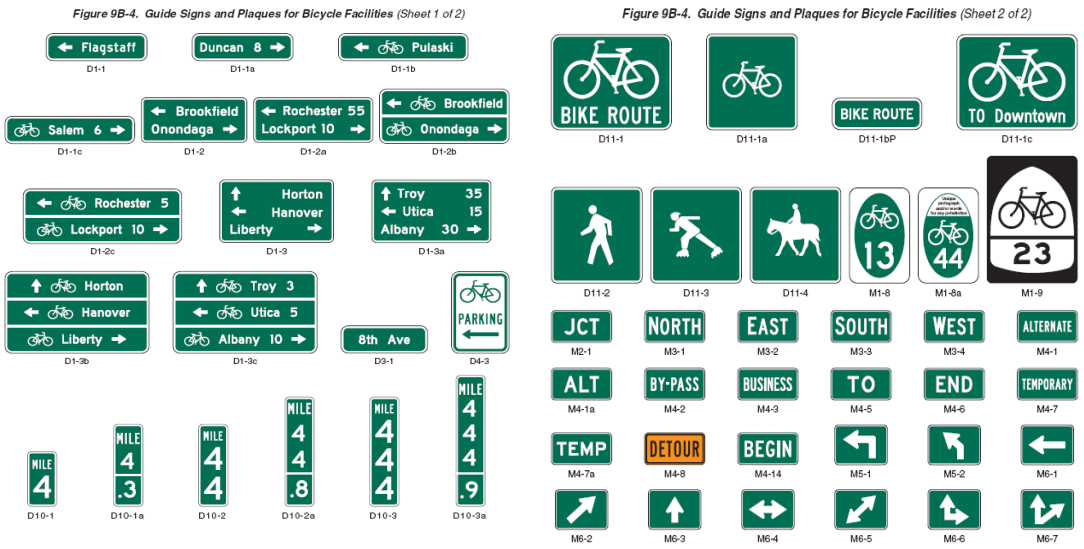


Figure 1.2: MUTCD Figure 9B-4. Guide Signs and Plaques for Bicycle Facilities

AASHTO

AASHTO recommends that typical (MUTCD-approved) bicycle route signs along designated bikeways include 'destination plates' directing cyclists to specific locations (e.g., downtown). In situations where a route is not officially designated as a bikeway, directional signage may still be used. Signs should be placed every 1,600 feet (500 meters), at all turns along the route, and at major signalized intersections. Typical sign placement is shown in Figure 1.3.

NACTO

National Association of City Transportation Officials (NACTO) recommends decision signs should include destinations, direction arrows, and distance. Travel time required to reach the destination provides bicyclists with additional information and may also be included. It is recommended that a 10 mph "urban average" bicycle speed be used for travel time calculations.

Figure 1.5 NACTO Recommended Bicycle Sign

Louisville Metro Proposed Change

Shown in Figure 1.4, is Louisville's proposed sign which meets the intent of the requirements for the D1-3c sign as described in Section 9B.20 of the MUTDC. Bicycle Wayfinding Signs would be placed within specific areas of Louisville Metro (Figure 2.1). The proposed sign is green and measures a maximum height of 33 inches and a width that varies depending on the destination name, with three horizontal dividers. Each divider is a half inch. Between each divider will be a panel which has room for two lines of primary text at two inches in height and Series D font and part of one line of subscript text at one and a half inch in height. The 'Series D' font is from the 'Standard Alphabet

for Traffic Control Devices' family and is supplied by the Federal Highway Administration. This sign can hold one to three destinations. If fewer than three destinations are displayed, the additional space may be used to accommodate longer destination names at the same font size by stacking labels across two lines. Appendix A contains a more detailed description of the proposed bicycle Wayfinding sign. A detailed image of the sign and its dimensions is included in Appendix A.

Public Input

Stakeholder meetings and an online survey were held by Bike Louisville throughout September, October, November and December 2010. Several meeting were hosted on bicycles, while cycling the Wayfinding network to ensure the nodes and routes met the group's expectations. The purpose of these meetings and survey were to gather input on sign concepts and develop a basic hierarchy of Wayfinding landmarks also known as nodes in and around Louisville.

Meeting attendees felt that bicycle Wayfinding signs should include one larger bicycle symbol on top while eliminating the smaller bicycle symbols on each of the panels while keeping the traditional MUTCD elements such as distance, direction and location. The general consensus echoed throughout the September – Decembers meetings, which was that Bike Louisville should adopt a similar ODOT-style sign for use within Louisville if the signs could adequately accommodate longer destination names when necessary.

SIGNAGE AND SIGN ELEMENT RECOMMENDATIONS

- **Signs should include mileage to help minimize the tendency to overestimate the amount of time it takes to travel by bicycle.** Feedback at the public meetings during September- December 2010 suggested that Louisville should consider using one larger bicycle symbol on top while eliminating the smaller bicycle symbols on each of the panels

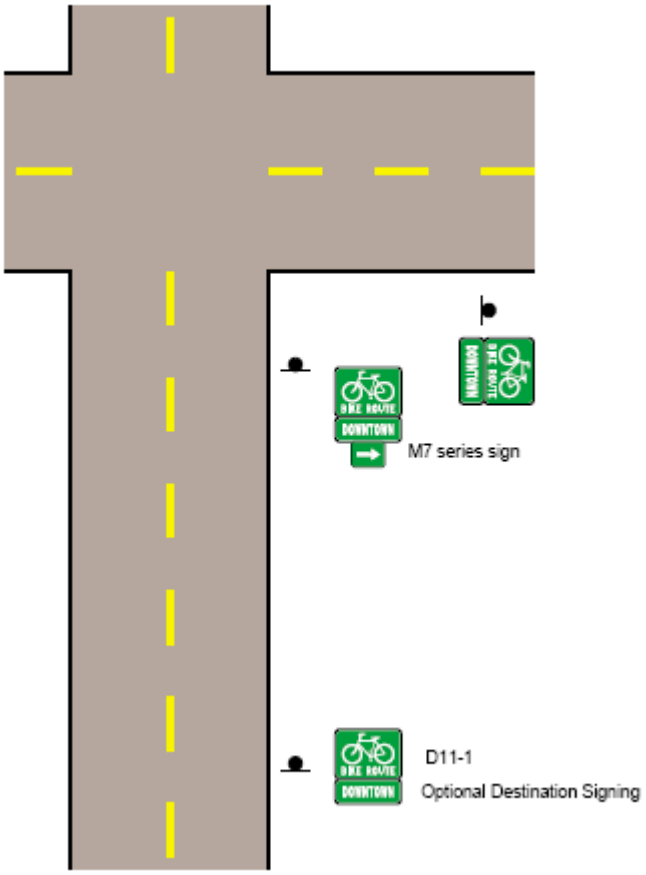


Figure 1.3 Typical sign placement

Figure 1.4 Proposed Bicycle Wayfinding Sign

- **Mileage for each destination will be listed when text is stacked, if possible.** Distance shall be listed on the same line of text to the right, of the destination.

- **The closest destination to each sign may not always be on top.** Destination will be in the order of straight ahead destination on top followed by destinations to the left and then destinations to the right.

- **Some signs are temporary or will contain future destinations.** Signs in some locations have space reserved for destinations that do not yet exist (e.g., phase II destinations). Future destinations and temporary signs are noted in Part 2 of this Plan.

SIGN PLACEMENT

- **Signs should be placed along the proposed bicycle Wayfinding signage network.** In cases where the bikeway does not yet exist, sign installation should occur simultaneously with, or immediately after, bikeway construction along the proposed bicycle Wayfinding signage network.

- **Signs should be placed in locations where the direction of the bike route is not immediately obvious (e.g., changes in direction), at intersections along all developed bikeways, at key decision points, and as guidance through difficult turns.**

- **At greater distances, area destinations (e.g., downtown and neighborhoods) should be signed as a general location.** As the distance to these areas decrease, specific destinations within the area can be named (e.g., 4th Street District).

- **Placement guidance from Portland suggests that signs should be placed along the right-of-way in places where the cyclist can see an upcoming sign from approximately 100 feet away.** On steep downhill segments, the sign should be placed further upstream from the intersection to provide a cyclist adequate time to make a directional decision. Signs should also be placed further from the intersection on busier streets with a center turn lane or left turn pocket to decrease the possibility of conflicting cyclist/motorist movements while preparing for a left turn.

- **Bike facilities to be signed are those included in the updated Transportation System Plan, included as figure 1.1** Installation of signage on bikeways outside Louisville's current development depends on future growth and annexation of these areas by Louisville.

- **Table 1 includes the signage placement standards for rights-of-way managed by Louisville and KYTC.** Standards that apply to placement of signs within KYTC right-of way also apply to bikeway signage. Installation of signs in KYTC rights-of-way should be done in upon receiving KYTC approval.

Table 1 – Signage Placement Standards

	Louisville Metro	KYTC
Vertical Clearance	Seven feet	Seven feet for a single sign or multiple sign assembly. Mounting

		height where any sign is located over a bike route is a minimum of 8'-0" from the ground line.
Horizontal Clearance	One foot behind curb, two feet behind shoulder	Six feet to face of guardrail. Where no barrier exists.
Post Style	Wood poles are preferred	Ground-mounted signs not protected by a guardrail or barrier must be breakaway. A four by four inch wooden post is considered to be breakaway.
Shared Support	Each sign should be on its own support. Signs may not be placed on utility poles.	Allowed.

SIGNED DESTINATIONS

Prior to selection of specific destinations, the Project Team gathered input on the relative importance of general landmark categories. Input from Metro staff and the public was used to develop a hierarchy of destinations of primary and secondary importance. Rankings were developed in part based on the stakeholder group's agreement that the primary target of these signs is recreational users or other cyclists not familiar with Louisville.

A destination's ranking in the hierarchy was used to help determine the physical distance from which locations are signed (e.g., one-quarter mile, or one-half mile). If more than three destinations can be signed at a potential location, those destinations considered to be more important were signed. Table 2 shows the general landmark categories and their standing in the signing hierarchy.

Table 1- Wayfinding landmark Categories and Hierarchy

Landmark Category	Hierarchy
Downtown	Primary
Commercial Center	Primary
Universities and Colleges	Secondary
Regional Parks and Trail (Louisville Loop)	Secondary
Adjacent Cities and Neighborhoods	Secondary
Public Transit Sites	Secondary

Civic/Community	Tertiary
Local Parks and Trails	Tertiary
Hospitals	Tertiary
Neighborhood Schools	Tertiary

Based on this exercise, a detailed list of potential destinations was developed, as shown in Table 2 and on Figures 2.1 through 2.3.

Timeline

The timeline for the implementation is proposed as follows:

Stage 1: Evaluation of Existing Conditions

- Fall 2010: Louisville collects preliminary data along proposed bicycle Wayfinding network Figure 2.1, to establish "before" conditions.
    - Crash data
    - Bike counts
    - Cyclist perspective

Stage 2: Install Bicycle Wayfinding Signage Network

- Fall 2011: Initial installation of the Bicycle Wayfinding Signage Network Figure 2.1.
- Continue to collect bike counts along the proposed bicycle Wayfinding network

Stage 3: Mid and Long-term Evaluation

- Two evaluations will occur subsequent to the initial installation; a mid term (one year) and a long term (two year): Louisville collects "after" data to evaluate further implications of the project.
    - Crash data
    - Bike counts
    - Cyclist perspective

Final Report

- Thirty months subsequent to installation: Louisville will complete all data.

PART TWO

Figure 2.1 - Bicycle Destinations

Table 3 - contains the list of abbreviations used to describe the approximate placement of signs.	
ID	Each Wayfinding sign as an ID which can be referenced from the table 4 to the Figure 2.1
Des_1	Refers to the first destination on the Wayfinding sign.
Distance	Distance it takes to reach the first destination on the Wayfinding sign.
Direction	The directional arrow used to reach the first destination on the Wayfinding sign.
Num_Dest	Number of destination on the Wayfinding sign
Orient	Intersection location of each Wayfinding sign with regards to North (N), South (S), East (E) and West (W).
Location	Address location for the placement of each Wayfinding sign
Des_2	Refers to the second destination on the Wayfinding sign.
Distance_2	Distance it takes to reach the second destination on the Wayfinding sign.
Dir_2	The directional arrow used to reach the second destination on the Wayfinding sign.
Des_3	Refers to the third destination on the Wayfinding sign.
Distance_3	Distance it takes to reach the third destination on the Wayfinding sign.
Dir_3	The directional arrow used to reach the third destination on the Wayfinding sign.

Figure 2.1 Wayfinding Network
See this map online:
http://services.louisvilleky.gov/media/bikelouisville/masterplan/Future_Bike_Facility_lowcost.pdf

Table 4- Detail Sign Placement

ID	Des_1
1.001	Bank St
1.002	Bank St
1.003	4th St. District
1.004	Bank St
1.005	4th St. District
1.006	Bank St
1.007	Bank St
1.008	Bank St
1.009	Broadway
1.010	Broadway
1.011	Downtown
1.012	Downtown
1.013	Downtown
1.014	Bank St
1.015	Downtown
1.016	Downtown
1.017	Bank St
1.018	Bank St
1.019	Downtown
1.020	Broadway
1.021	Bank St
1.022	Bank
1.023	Downtown

Table 4- Detail Sign Placement

ID	Des_1
1.024	Bank St
1.025	Broadway
1.026	Downtown
1.027	Bank St
1.028	Broadway
1.029	Bank St
1.030	Broadway
1.031	Bank St
1.032	Bank St
1.033	Broadway
1.034	Bank St
1.035	Dixie
1.036	Broadway
1.037	Bank St
1.038	Broadway
1.039	Broadway
1.040	Broadway
1.041	Broadway
1.042	Broadway
1.043	Broadway
1.044	Downtown
1.045	Downtown
1.046	Broadway

Table 4- Detail Sign Placement

ID	Des_1
1.047	Downtown
1.048	Downtown
1.049	Broadway
1.050	Broadway
1.051	Broadway
1.052	Downtown
1.053	Downtown
1.054	4th St. District
1.055	Downtown
2.001	Dixie
2.002	Broadway
2.003	Broadway
2.004	Dixie
2.005	Broadway
2.006	Dixie
2.007	Broadway
2.008	Dixie
2.009	Broadway
2.010	Dixie
2.011	UofL
2.012	Broadway
2.013	Dixie Hwy
2.014	UofL

Table 4- Detail Sign Placement

ID	Des_1
2.015	Dixie
2.016	UofL
2.017	Dixie
2.018	UofL
2.019	UofL
2.020	Broadway
2.021	Dixie Hwy
2.022	Broadway
2.023	Broadway
2.024	Downtown
2.025	Broadway
2.026	Downtown
2.027	Broadway
2.028	Broadway
2.029	Downtown
2.030	Downtown
2.031	Broadway
2.032	Downtown
2.033	Broadway
2.034	Downtown
2.035	Broadway
2.036	Dixie Hwy
2.037	Downtown

Table 4- Detail Sign Placement

ID	Des_1
2.038	Dixie Hwy
2.039	Dixie Hwy
2.040	Dixie Hwy
2.041	Downtown
2.042	UofL
2.043	Dixie Hwy
2.044	UofL
2.045	Dixie Hwy
2.046	UofL
2.047	Dixie Hwy
2.048	Dixie Hwy
3.001	Downtown
3.002	Downtown
3.003	Downtown
3.004	Downtown
3.005	UofL
3.006	Bardstown Rd
3.007	UofL
3.008	Bardstown Rd
3.009	UofL
3.010	Bardstown Rd
3.011	UofL
3.012	Bardstown Rd

Table 4- Detail Sign Placement

ID	Des_1
3.013	UofL
3.014	Bardstown Rd
3.015	UofL
3.016	Barstown Rd
3.017	UofL
3.018	Bardstown Rd
3.019	UofL
3.020	Bardstown Rd
3.021	UofL
3.022	Bardstown Rd
3.023	UofL
3.024	Bardstown Rd
3.025	UofL
3.026	Bardstown Rd
3.027	UofL
3.028	Barstown Rd
3.029	UofL
4.001	UofL
4.002	4th St. District
4.003	4th St. District
4.004	UofL
4.005	Downtown
4.006	UofL

Table 4- Detail Sign Placement

ID	Des_1
4.007	Downtown
4.008	UofL
4.009	Downtown
4.010	UofL
4.011	UofL
4.012	Downtown
4.013	Downtown
4.014	UofL
4.015	Downtown
4.016	Downtown
4.017	Downtown
4.018	UofL
4.019	Downtown
4.020	Bardstown
4.021	Downtown
4.022	Downtown
4.023	Bardstown Rd
4.024	Bardstown Rd
4.025	Bardstown Rd
4.026	Downtown
4.027	Downtown
4.028	Barstown Rd
4.029	Barstown Rd

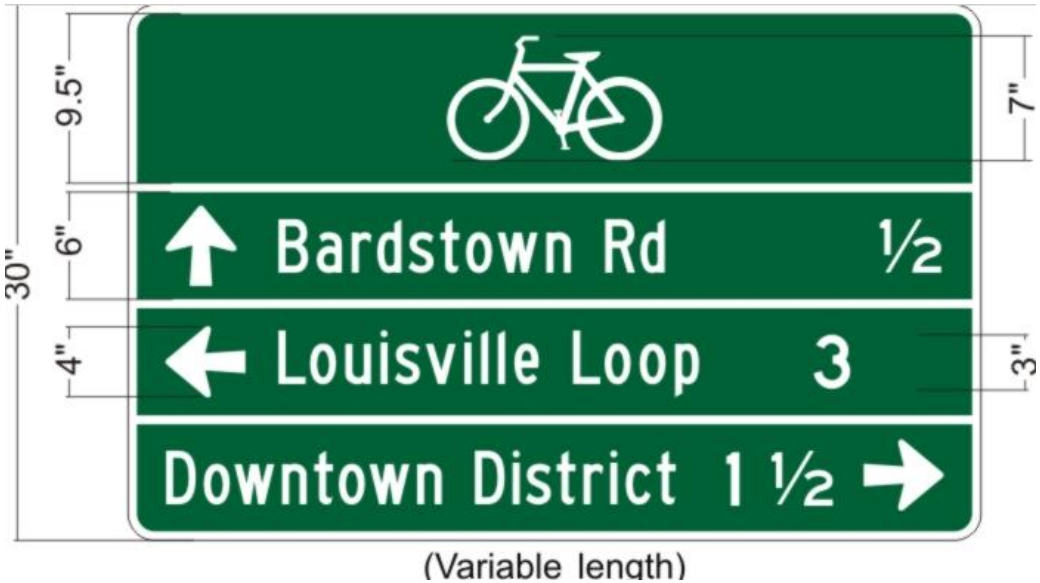
Table 4- Detail Sign Placement

ID	Des_1
4.030	UofL
4.031	UofL
4.032	Bardstown Rd
4.033	Barstown Rd
4.034	UofL
4.035	Barstown Rd
4.036	4th St. District
4.037	Bardstown Rd
4.038	4th St. District
4.039	4th St. District
4.040	4th St. District
4.041	4th St. District
4.042	Frankfort Ave
4.043	Bardstown
4.044	Downtown
4.045	Bardstown Rd
4.046	4th St. District
4.047	Downtown
4.048	Downtown
4.049	4th St. District
4.050	4th St. District
4.051	Downtown
4.052	Downtown

Table 4- Detail Sign Placement

ID	Des_1
4.053	Frankfort Ave
4.054	Downtown
4.055	Frankfort Ave
4.056	Downtown
4.057	Frankfort Ave
4.058	Downtown
4.059	Frankfort Ave
4.060	Downtown
4.061	Frankfort Ave
4.062	Frankfort Ave
4.063	Downtown
4.064	Frankfort Ave
4.065	Barstown Rd
4.066	Barstown Rd
4.067	Frankfort Ave
4.068	Barstown Rd
4.069	Frankfort Ave
4.070	Barstown Rd
4.071	Frankfort Ave
4.072	Frankfort Ave
4.073	Barstown Rd
4.074	4th St. District
4.075	Barstown Rd

Appendix A


9.5"
6"
4"
30"
7"
3"
Bardstown Rd ½
Louisville Loop 3
Downtown District 1 ½
(Variable length)